Washington State Department of Transportation

Reference Page - Terrestrial Habitat Connectivity Considerations in Fish Barrier Removal Projects

To streamline the Habitat Connectivity Memo process for fish barrier removals, habitat connectivity recommendations will be provided via tables, the components of which are described below. Rather than provide a multi-page memo summarizing background information for each location, we will schedule consultation meetings to discuss recommendations, justification, and background information, if desired. See the "Consultation" section for instructions on scheduling a meeting.

Memo Trigger

Habitat Connectivity Memos are triggered when a project is scheduled in or adjacent to a high priority area, as determined by WSDOT's Habitat Connectivity Investment Priorities (HCIP), or when a memo is requested by a project team member for a location that did not originally fall within or adjacent to a high priority area identified by the HCIP. If a memo trigger is listed as "HCIP," it means that project falls in or adjacent to a high-ranking area.

Road Fill

The amount of road fill often dictates what size structure could realistically fit within the landscape. This column estimates road fill at each location, determined during a site visit.

Structure Size Recommendation

Structure size recommendations are determined by the species assemblages that occupy, or are expected to utilize, habitat adjacent to the fish barrier removal project location. Structure size recommendations fall into one of three categories: Medium Structure, Large Structure and Stream Simulation. Previous research conducted outside the agency, as well as by WSDOT Habitat Connectivity staff, has determined the recommended dimensions and openness ratios for each category lead to consistent use by associated species. The minimum structure dimensions and openness ratios for each category are described below.

- **Medium Structure** - minimum of 20 ft wide, minimum of 10 ft of vertical clearance, minimum openness ratio of 2.0. Structures meeting all minimum size requirements will reliably be used by deer species, as well as the majority of other species in the state, excluding elk, grizzly bears, pronghorn antelope and greater sage grouse.
- **Large Structure** - minimum of 60 ft wide, minimum of 15 ft of vertical clearance, minimum openness ratio of 18.0. Structures meeting all minimum size requirements will reliably be used by all species in the state, including elk, grizzly bears, pronghorn antelope and greater sage grouse. When it comes to wildlife crossing structures, bigger is always better; however, Large Structures are only recommended where species requiring such structures, usually elk, are present or expected to be present.
- **Stream Simulation** - a structure sized using stream simulation will provide safe passage for a subset of wildlife. Since Stream Simulation structures usually result in lesser than the recommended minimum criteria for Medium Structures, they will not reliably be used by deer species, but other species like black bear, bobcat, coyote, raccoon and more will utilize them if enough vertical clearance is provided to allow the animal to fit. Stream Simulation-sized structures are usually recommended at high priority locations that lack adequate road fill to

achieve vertical clearance requirements for deer and/or elk without raising the level of the roadway.

Openness Ratio
The openness ratio is a metric that helps determine appropriate sizing for wildlife crossing structures and is especially important to consider for large and medium-sized animals like deer and elk. The openness ratio is defined as the structure's **(width x vertical clearance) / length**. Another way to think about calculating the openness ratio, especially for irregular structures, is **dividing a structure's cross-sectional area by its length**. The openness ratio must be calculated in feet to match our recommendations.

As the openness ratio is a function of structure length, which corresponds to the width of the roadway, structure length will be determined by road width. Structure width and vertical clearance may need to be adjusted above minimum sizing recommendations to achieve the recommended level of openness. Medium Structures typically achieve the recommended level of openness on highways up to four lanes wide (roughly equating to a 100 ft long structure) when they meet minimum width and vertical clearance recommendations. Achieving minimum openness recommendations on highways more than four lanes wide will likely require increasing structure width or vertical clearance above the minimum recommendations. Large Structures typically achieve the recommended level of openness on two-lane highways (roughly equating to a 50 ft long structure) when they meet minimum width and vertical clearance recommendations. Providing the appropriate level of openness contributes to consistent use by large mammals by allowing sight through a crossing structure, as well as by providing more natural lighting conditions, as many species prefer open lines of sight and avoid long and dark tunnel-like structures.

Wildlife Benches (example photos below)
Wildlife benches should be located above the 2-year flood level to provide a dry path through the structure all or most of the year to facilitate wildlife passage. The wildlife bench should mimic natural substrate as much as possible, akin to what would be found along a hiking trail in habitat adjacent to the structure. Benches are especially important for small or water-averse species unwilling to swim or wade. Wildlife bench width is typically determined by the size of the structure recommended:

- 3-5 ft wide bench, typically associated with structures sized using Stream Simulation
- 5 ft wide bench, typically associated with Medium Structures
- 10 ft wide bench, typically associated with Large Structures

Consultation
Terrestrial habitat connectivity recommendations for fish barrier removal projects are based on field assessments and in-depth reviews of relevant wildlife data adjacent to the project area. While not required, if you are interested in scheduling a one-hour coordination meeting with the WSDOT Habitat Connectivity Team to review the background information that was used to formulate these recommendations, please contact Glen Kalisz, Habitat Connectivity Biologist (glen.kalisz@wsdot.wa.gov).

Wildlife bench example at a medium structure.

Wildlife bench example at a medium structure.

Wildlife bench example at a large structure.

Wildlife bench example at a large structure.

Wildlife bench example at a stream simulation structure.

Small mammal tracks along wildlife bench from the stream simulation structure above.